

The invention in which an exclusive right is claimed is defined by the following:

1. A method for assisting a user to manually focus a camera, comprising the steps of:

(a) processing image data produced by the camera to produce a sharpness value that is indicative of a sharpness of focus of the camera in at least a portion of an image;

(b) enabling the user to manually focus the camera; and

(c) providing an indication of the focus of the camera to the user as the user manually focuses the camera, to enable the user to adjust the focus of the camera to selectively achieve the sharpest focus possible.

2. The method of Claim 1, wherein the image data comprise a luminance value for each of a plurality of pixels comprising the image, said step of processing comprising the steps of:

(a) determining a luminance value for pixels disposed in at least said portion of the image;

(b) comparing the luminance value of adjacent pixels disposed in at least said portion of the image to determine differences in their luminance values; and

(c) determining the sharpness value as a function of the differences in the luminance values of adjacent pixels in at least said portion of the image.

3. The method of Claim 2, wherein the step of determining the sharpness value comprises the step of determining a running total of the differences between the luminance values of adjacent pixels in both a horizontal and a vertical direction.

4. The method of Claim 2, wherein at least said portion of the image comprises at least one of a central portion of the image and side portions of the image.

5. The method of Claim 4, further comprising the step of weighting the luminance values in selected regions of the image included within at least said portion of the image when determining the sharpness value.

6. The method of Claim 1, wherein the step of providing an indication comprises the step of displaying a visual indicator corresponding to the sharpness value so that the focus of the camera is visually perceived by the user viewing the visual indicator.

7. The method of Claim 6, wherein the step of displaying a visual indicator comprises the step of displaying a graphical indicator of the sharpness value.

8. The method of Claim 7, wherein in the step of displaying a visual indicator further comprises the step of indicating a maximum of the sharpness value on the graphical indicator so that as the user adjusts the focus of the camera past a point of sharpest focus, the user is enabled to reverse the adjustment of the focus back to the point of sharpest focus corresponding to the maximum of the sharpness value.

9. The method of Claim 1, wherein the step of providing an indication comprises the step of producing an audible sound indicative of the user achieving the sharpest focus as the user focuses the camera.

10. The method of Claim 1, further comprising the step of enabling the user to link the camera in data communication with a host computing device so that the step of digitally processing the image data is carried out by the host computing device.

11. The method of Claim 1, wherein the step of digitally processing the image data is carried out by a logic device included within the camera; and wherein the step of providing an indication uses at least one of an audible indication and a visual indication.

12. The method of Claim 11, wherein the audible indication comprises a sound having a varying audible frequency indicative of the sharpness value.

13. The method of Claim 11, wherein the visual indication comprises at least one of a light having a varying color indicative of the sharpness value, a digital display of a number indicative of the sharpness value, a graphical display indicative of the sharpness value, and a meter that indicates the sharpness value.

14. The method of Claim 1, wherein the step of digitally processing the image data includes the step of determining a weighted average of luminance for different regions of the image.

15. A memory medium on which machine readable instructions are stored, said machine readable instructions, when implemented by a processor, causing steps (a) and (c) in Claim 1 to be carried out.

16. A method for assisting a user to focus a camera that is coupled to a host computing device on which an image produced using image data from the camera is displayed, said method comprising the steps of:

(a) digitally processing the image data from the camera using the host computing device, to determine a sharpness value indicative of a focus of the camera;

(b) in response to changes in the focus caused by the user adjusting the focus of the camera, again determining the sharpness value by digitally processing the image data; and

(c) indicating the sharpness of focus of the camera to the user as a function of the sharpness value.

17. The method of Claim 16, wherein the image data comprise a luminance value for each of a plurality of pixels comprising the image, said step of digitally processing comprising the steps of:

(a) determining a luminance value for pixels comprising the image;

(b) comparing the luminance value of pixels that are adjacent to each other to determine differences in the luminance values; and

(c) determining the sharpness value as a function of the differences in the luminance values.

18. The method of Claim 17, wherein the pixels are disposed in one or more predetermined regions of the image.

19. The method of Claim 17, wherein the step of digitally processing further comprises the step of determining a running total of the differences in at least one of a horizontal and a vertical direction.

20. The method of Claim 17, wherein the step of digitally processing further comprises the step of weighting the difference in the luminance for pixels in at least one predefined portion of the image, when determining the sharpness value.

21. The method of Claim 16, wherein the step of indicating comprises the step of providing at least one of a visual and an aural indication of the sharpness value as the user adjusts the focus of the camera.

22. The method of Claim 21, wherein the step of providing the visual indication includes the steps of:

- (a) displaying a graphical indication of the sharpness value; and
- (b) displaying an indication of a maximum of the sharpness value that is achieved as a result of the user adjusting the focus of the camera, so that having adjusted the focus past a sharpest possible focus corresponding to the maximum, the user can readily adjust the focus back to the sharpest possible focus indicated by the maximum that was previously achieved.

23. A system that provides an indication of sharpness of focus to assist a user in focusing an image, comprising:

- (a) a camera that includes a lens having a manually adjustable focus control, said camera including a light sensor that produces image data in response to light passing through the lens;
- (b) a logic device coupled to receive the image data from the light sensor;
- (c) an indicator, coupled to the logic device, said indicator being adapted to provide an indication of a sharpness of focus of the lens; and
- (d) said logic device being configured to implement a plurality of functions, including:
 - (i) processing the image data from the light sensor to determine a sharpness value indicative of a focus of the lens; and
 - (ii) indicating to a user the focus of the lens with the indicator, as a function of the sharpness value, so that a user can determine when the lens is sharply focused.

24. The system of Claim 23, wherein at least one of the logic device and the indicator are disposed within the camera.

25. The system of Claim 24, wherein the indicator comprises at least one of an audio indicator and a visual indicator.

26. The system of Claim 25, wherein the visual indicator comprises at least one of a light having a color that is indicative of the sharpness value, a graphic display that is indicative of the sharpness value, and a meter that indicates the sharpness value.

27. The system of Claim 25, wherein the audio indicator produces an audible sound having a frequency that is indicative of sharpness value.

28. The system of Claim 23, wherein the camera is adapted to couple to a host computing device in which at least one of the logic device and the indicator are disposed.

29. The system of Claim 23, wherein the image data comprise a luminance value for each of a plurality of pixels comprising the image, said logic device:

(a) determining a luminance value for pixels comprising the image;

(b) comparing the luminance value of pixels that are adjacent to each other to determine differences in their luminance values; and

(c) determining the sharpness value as a function of the differences in the luminance values.

30. The system of Claim 29, wherein the pixels are disposed in one or more predetermined regions of the image.

31. The system of Claim 29, wherein the processor determines a running total of the differences in at least one of a horizontal and a vertical direction.

32. The system of Claim 29, wherein the logic device weights the difference in the luminance for pixels in at least one predefined portion of the image, when determining the sharpness value.

33. A logic device-readable medium having machine instructions, which when executed by a logic device, cause a plurality of functions to be implemented, including:

(a) processing image data from a camera to produce a sharpness value that is indicative of a sharpness of focus of a lens of the camera in at least a portion of an image; and

(b) in response to a user manually focusing a lens of the camera so as to change the sharpness value, providing an indication of the focus, to enable a user to selectively improve a sharpness of focus.

34. The logic device-readable medium of Claim 33, wherein the image data that are processed comprise a luminance value for each of a plurality of pixels comprising the image, said machine instructions causing the logic device to:

(a) determine a luminance value for pixels disposed in at least said portion of the image;

(b) comparing the luminance value of adjacent pixels disposed in at least said portion of the image to determine differences in their luminance values; and

(c) determine the sharpness value as a function of the differences in the luminance values of adjacent pixels in at least said portion of the image.

35. The logic device-readable medium of Claim 34, wherein said machine instructions determine the sharpness value by determining a running total of the differences between the luminance values of adjacent pixels in both a horizontal and a vertical direction.

36. The logic device-readable medium of Claim 34, wherein at least said portion of the image comprises at least one of a central portion of the image and side portions of the image.

37. The logic device-readable medium of Claim 36, wherein the machine instructions further cause the logic device to weight the luminance values in selected regions of the image included within at least said portion of the image when determining the sharpness value.

38. The logic device-readable medium of Claim 33, wherein the machine instructions cause a visual indicator to be displayed and varied as a function of the sharpness value, so that the a focus of the lens is visually perceived by a user viewing the visual indicator.

39. The logic device-readable medium of Claim 38, wherein the machine instructions cause a graphical indicator to be displayed to indicate the sharpness value.

40. The logic device-readable medium of Claim 38, wherein the machine instructions further cause the logic device to indicate a maximum of the sharpness value on the graphical indicator so that as a user adjusts the focus past a point of sharpest focus, a user is enabled to readily reverse the adjustment of the focus back to the point of sharpest focus, corresponding to the maximum of the sharpness value.

41. The logic device-readable medium of Claim 33, further comprising an audio transducer coupled to the logic device, wherein the machine instructions cause the logic device to produce an audible sound indicative of a user achieving the sharpest focus as a user focuses the lens.

42. The logic device-readable medium of Claim 41, wherein the audible sound has a varying audible frequency indicative of the sharpness value.

43. The logic device-readable medium of Claim 33, wherein the indication of focus comprises at least one of a colored light display, a numeric display, a graphical display, and a meter indication.

44. The logic device-readable medium of Claim 33, wherein the machine instructions further cause the logic device to determine a weighted average of luminance for different regions of the image and to provide the indication of sharpness of focus as a function of the weighted average.